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ABSTRACT

Described is the development of an observation instrument that is designed to give a measure of the overall teaching strategy or style used by a teacher including both verbal and non-verbal interactions between teachers, students, and the physical materials which constitute the classroom environment. The instrument was developed to give a single rating of a teacher's style, representing his position on a continuum which can be described in very general terms with extremes defined as (1) expository-direct teaching and (2) inductive-indirect teaching. The instrument based on this model of teaching passed through several versions during its three years of development; however, in all versions, a rating of teaching style on a numerical scale is given for each one minute interval. Several versions of the instrument have been used in two studies of elementary school science teaching, one secondary science study, and one study of elementary school social studies. (BR)

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DEVELOPMENT OF A VERBAL AND NON-VERBAL OBSERVATION INSTRUMENT

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DEVELOPMENT OF A VERBAL AND NON-VERBAL OBSERVATION INSTRUMENT*

Both research endeavors and teacher education activities have created a need for observation instruments that can be used to systematically record the activities in classrooms and to serve as a vehicle to communicate to other persons the nature of these activities. Although there are literally hundreds of such instruments available, the work reported herein was undertaken because no instrument was available which meet the needs of the writers. The need was for an instrument which would give a measure of the overall teaching strategy or style used by a teacher including both verbal and non-verbal interactions between teachers, students and the physical materials which constitute the classroom environment. The original work with this instrument, called the Teaching Strategies Observation Differential (TSOD), began in the context of elementary school science and has been extended to the secondary level and to other areas of the curriculum. The need for a broader instrument of this type has been spurred by the development of new curricular programs in which students are expected to work extensively with

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*As with many research efforts, the work reported herein extended over a considerable period of time with the authors and several other persons involved in various ways. The development of the original of the three versions of the instrument, and its rationale, was the work of Joseph A. Struthers. Further developmental work resulting in the other two versions was conducted by Ronald D. Anderson and several graduate students at the University of Colorado. One of them, Helen H. James, was involved in the development of all three versions. Others who contributed to its development were Daniel Bauman, Edward DeAvila, Thomas Gier, Jerry G. Horn, and particularly Arthur L. White.

materials other than the traditional books, papers, and pencils (e.g. the use of centimeter rods and attribute blocks in mathmatics, and elementary school science programs with extensive materials for individual student use but with minimal reading materials.)

It should be stated at the outset that the need for this instrument, its development and use are all governed by the frame of reference of the developers, their conceptions of what events are significant to the learning process and their beliefs about teachers' roles. Any classroom observer and any systematic observation instrument selects out of a complex system those events deemed significant and hence are theory laden either through stated or unstated assumptions. The educational objectives and approaches to learning generally encouraged through the modern curriculum development projects are basic to the rationale of the observation instrument reported.

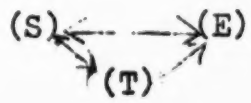
The instrument was developed to give a single rating of a teacher's style, representing his position on a continuum which can be described in very general terms with extremes defined as follows: (1) expository - direct teaching and (2) inductive - indirect teaching. The former is represented by this diagram:

(S) (T) (E)

which shows interactions between the teacher(T), the student(S) and the environment (E). E is a broad category including materials such as centimeter rods, paint brushes, globes, or chemicals, and natural phenomena that might be studied in a science class. The arrows represent interactions between the components. In this mode of teaching, the teacher serves in the role of interpreter, explaining and describing the environment to the learners. This approach can include such activities as asking questions

and reinforcing correct answers, answering student questions, citing authoritative sources, demonstrating through the manipulation of equipment and narrative explanation.

The inductive - indirect approach is represented by the following diagram:



This diagram uses the same symbols to depict interactions under the inductive - indirect mode. In this mode the teacher acts to place the student in direct contact with the environment. The teacher responds to questions in such a way as to cause the student to search for his own answers. The essential ingredient in this mode of teaching is the direct student reception of input from the environment and other students without the teacher's interpretation.

The instrument based on this model of teaching has paased through several versions during its three years of development but basically they all belong to one of three main versions which have been used in various studies of teaching style. For purposes of identification they will be labelled alpha, beta, and gamma. In all versions, a rating of teaching style on a numerical scale is given for each one minute interval. The determination of whether an inductive - indirect or expository - direct function is being served requires the observation of a sizable amount of behavior and an inference on the part of the observer.

ALPHA. The teacher behaviors that were recorded and the coding utilized are seen in the following summary of the events. In addition

to recording the events described under I, II, and III below, the observer made a rating of the style of teaching on a continuum scaled from one to nine, with the extremes being the two styles described above.

I. Instructional Events (Inductive or Expository Teaching Behavior)

1. Manipulates environment
2. Asks questions
3. Listens to student
4. Responds to student questions
5. Makes statements of fact
6. States opinion

II. Managerial Events

A. Rapport maintenance
   A+ Positive affective action (encouragement, praise, etc.)
   AO Neutral affective action (arbitration of dispute, etc.)
   A- Negative affective action (threat, display of anger, ect.)

B. Procedural actions

P(1) Verbal procedural instructions
P(2) Non verbal procedural instructions

III. Other Events

N(1) Uninterpretable event
N(2) Missing data (video tape malfunction, etc.)
S Silence

A sample observation of a one-minute interval is as follows:

Interval	Sequence	0 - 0 - 0	Rating	0 - 0 0
37	3,4,1,2,A+,P(2)	1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9 :		

This would mean the following sequence: During the 37th minute the teacher listens to a student, responds to the student's question, manipulates a piece of equipment, asks a question, encourages the student to try the same manipulation, and oversees the student's activities without comment.

The overall rating for the sequence of events of the minute is three

scale units toward the inductive side of neutral as shown by the encircled eight under the rating heading.

A team of three persons, two graduate students and a fifth grade teacher, collaborated in the refinement of the observation system and trained themselves in its use by viewing films and videotaped examples of inductive - indirect and expository - direct teaching. Through repeated observations they arrived at a consensus for the inferences made and individual operational definitions of what constituted a particular rating on the one to nine scale. After this period of development they obtained an inter-judge reliability (Hoyt)[1] of r = .79 for independently rated videotapes.

BETA. As with alpha, beta was developed for use in science classrooms. The events described in I, II, and III for alpha were recorded originally in the hope that they would aid in making the rating of teaching style on the one to nine scale, which was the major outcome sought from use of the observation instrument. Since the benefit was not as great as had been hoped the recording of these events was eliminated from Beta. Furthermore, a set of descriptors was formulated to aid the observer in making the overall rating of teaching style during each one minute interval. These descriptors, or operational definitions, were formalized and used as the basis for making the ratings rather than basing the ratings exclusively on the individual mental images developed through consensus of a group of observers. The descriptors are examples of behaviors which illustrate a position on the scale and are given only as a guide to marking the intervals of the instrument. Other incidents necessitate an additional interpretation by the observer. The descriptors are as follows:

I. DIRECT VERBAL

1. Fact: direct exposition of science content (e.g. lecture)

2. Direction or Opinion: direct instruction on "how to" or direct influence on class activities through stated opinions

3. Questions: structured for definite answer, or accepted only if the "correct" answer given

II. DIRECT NON-VERBAL

4. Demonstration: direct instruction using equipment, book, chalkboard, etc. - either before whole class or for a group or individual

III. INDIRECT VERBAL

5. Teacher questioning: questions and responses of an open-ended nature

6. Student questioning: questions and responses by students

IV. INDIRECT NON-VERBAL

7. Teacher determined student experimentation: laboratory activities that are largely determined by oral teacher directions or a printed laboratory manuel

8. Student determined student experimentation: laboratory activities in which the students play a major role in determining the questions to be investigated and the procedures used

V. NOT SPECIFICALLY RELATED TO SCIENCE INSTRUCTION

9. e.g. a) Prolonged silence
b) Confusion
c) Procedural matters

A segment of the record sheet used is reproduced below.

INTERVAL	DOODLE SPACE	RATING
1		1 2 3 4 5 6 7 8 9
2		1 2 3 4 5 6 7 8 9
3		1 2 3 4 5 6 7 8 9
4		1 2 3 4 5 6 7 8 9

At the end of each one minute interval the observer records a rating for

that interval by circling the appropriate number. This number does not necessarily describe the actual behaviors in accord with the numbered items above. For example, the observer might judge that about one half of the minute interval was best described by 4 and the other half best described by 2. In this case, he would circle 3 on the record sheet, since it would be most indicative of the overall approach of the one minute interval. The "doodle space" is used in various ways by observers to aid themselves in this determination. At the end of the observation session, the mean of the ratings of the one minute intervals is computed and used as an overall indicator of the teacher's style during that class. It should be emphasized that the end product is a single numerical indicator of the overall style of teaching and it is not possible to determine from this rating what specific behaviors occurred during the class session, even though the descriptors given above were used as the basis for making the ratings. In addition, it should be pointed out that this rating is not a measure of the effectiveness with which this style was employed.

The Hoyt inter-rater reliability of this version ranged between .89 and .97 for seven different pairs of raters with an average inter-rater reliability of .94.

GAMMA. This third version of the instrument is different from the previous in two major ways. (1) It was adapted for use in all subject areas wherein children's manipulation of the environment is involved, and (2) the focus of the observation is sometimes shifted from the teacher to selected students. The first change was accomplished mainly through re-wording the categories in language that is more general and less specific to science.

The second change is a shift in the procedure followed by the

observer. In the alpha and beta versions the observer was to continually focus on the behavior of the teacher. This could sometimes result in misleading ratings when the teaching strategy employed was encouragement of independent work by students either as individuals or small groups. To alleviate this problem the categories of the instrument were defined in terms of the behaviors of both teachers and students and the observation procedure was modified. If the teacher is employing a teaching strategy in which the entire class is expected to attend to the teacher or that which the teacher determines, the observer is to focus on the teacher and his interactions with students. If the style employed is one in which the students are expected to work independently as individuals or small groups, the observer shifts his observation to six randomly selected students. Each of the six students is observed for one minute in a randomly selected order with the pattern of observation being repeated as long as observation of this type of activity continues.

The requirement of close observation of both teacher and students necessitates either observation by observers who are actually in the classroom or a video tape recorder operator who is employing the necessary procedures for sampling student behavior. Thus far, this version of the instrument has been used only with "live" observers.

The categories for gamma are as follows. Note that movement along the scale from one to ten represents movement from an area of student passivity through an area of overlap of expository - direct and inductive - indirect techniques to an area of student autonomous activity.

I. NON-EDUCATIONAL ACTIVITIES

O_1 Non-educational activities beyond the teachers control.

This category includes class interruptions, such as announcements on the intercom, which are not under the control of the teacher. This zero rating is not averaged into the overall rating.

O_2 Teacher controllable non-educational activities. This category includes managerial tasks (e.g. taking role), off-subject discourse and other activities which the observer judges to be "non-educational" but are normally expected to be susceptable to teacher influence.

II. DIRECT VERBAL

In this category the students are either passive or at most responding only in a limited verbal way to teacher stimuli.

1. Facts: e.g. direct exposition of content as in lectures by the teachers. Students are involved only as listeners.

2. Direction or opinion: e.g. direct instruction on "how to" or direct influence on class activities through stated opinions. The students are involved only as listeners but the teacher's talk is presumed to be a prelude to student activity.

3. Limiting questions: questions structured for a definite and specific answer, or for which only the "correct" answer is accepted. Student involvement is limited to one word or phrase response to teacher questions.

III. DIRECT NON-VERBAL

In this category, student activity is heavily teacher dominated but includes non-verbal activity as well as verbal.

4. Demonstration: direct instruction using equipment, books, chalkboard, etc. either before the whole class or in a manner as would affect most of the class, e.g. showing several individuals or small groups "how a reaction must be obtained." The students role is that of observer as well as listener but interaction with the teacher is limited to simple clarification of teacher verbalization.

5. Student exercises: students are following the directions of a recipe (presented either orally or in visual form) in working with materials such as laboratory equipment, maps or tools. The students' activities are determined by the teacher in a manner that results in student's thought and actions being directed toward pre-specified or "correct" results.

IV. INDIRECT VERBAL

This category is characterized by verbal interaction between teacher and students, and between students and students, which goes beyond simple and limited response to teacher stimuli. The students' verbalization influences the pattern of the interaction.

6. Teacher questions: questions of an open ended nature which are probing and necessitate individual student thought and for which variations in response are accepted. Students play a major role in determining the pattern of the verbal interaction.

7. Teacher response: teacher is responding to student questions or comments. The response may or may not be demanded by the student vervali$_z$ation and it may itself be a question, but it is in direct response to student's questions or comments.

8. Teacher guidance: teacher guidance of inter-student discussion, planning, or presentation to stimulate and keep it thought provoking and to avoid shallowness and tangential trivia. The interaction is largely between students and the teacher serves only in the role of moderator or consultant.

V. INDIRECT NON-VERBAL

This category is characterized by student work that is not limited to verbal activity, but includes work with materials. In addition, the activity is not teacher dominated but gives the student varying degrees of autonomy.

9. Teacher planned investigation: student investigations in which the problems pursued are determined by the teacher, laboratory manual or guide rather than by the student. Outcomes, however, are not pre-specified, i.e. no specific "recipe" is followed and all students do not necessarily follow the same routine.

10. Student planned investigations: student investigations in which the student participates in determining the specific problem he will pursue. The investigation is student planned and conducted and the teacher's guidance is limited to monitoring, encouragement, and reference help.

The gamma version as employed in the initial stages of a study of elementary school social studies yielded a Hoyt inter-rater reliability[1] of .88 when used by two observers each observing the same two classes of sixteen different teachers.

RESULTS OF USE OF THE INSTRUMENT

The several versions of the instrument have been used in two studies of elementary school science teaching, one secondary school science study, and one study of elementary school social studies. The two elementary science studies [2,3] and the secondary science study [4] will be reported elsewhere and the social studies research is still in process. Portions of these studies provide some evidence of the usability and validity of the instrument.

In one of the elementary science studies, [2] alpha was employed to obtain measures of the teaching style of teachers for whom measures were also obtained of changes in their students' creative and critical thinking ability over a period of one school year. The study included twenty randomly selected fourth, fifth, and sixth grade teachers. Approximately sixty minutes of each teacher's teaching was recorded on video tape and rated at a later time.

Questions of interpretation concerning the scoring arose in the use of alpha in this study. A five rating might mean either that a teacher alternated between inductive and expository styles or that neither style was observed. On review of the data, it became apparent that large fluctuations between inductive and expository styles were not observed.

There were consistent uses of a particular style among teachers on both ends of the continum. Further, the raters agreed that the 5 rating was used essentially as a neutral one suggesting that the behavior observed did not fit either the expository - direct or the inductive - indirect model. As a consequence, the teachers were divided into three groups labeled expository, inderminate and inductive, and the analysis was made on this basis.

The most striking outcome of this study was that children in classes rated as indeterminate predominately showed losses in critical and creative thinking scores while gains occured both in classes rated as expository and those rated as inductive. If brief, it appears that benefits obtained to children in classes where the teacher displayed a teaching style but it did not matter if that style was expository or inductive. The differences were most noticeable in the creative thinking scales.

In the second elementary science study [3], beta was used as the means of appraising the change in teaching style resulting from an in-service training program in the use of new elementary school science materials. A relatively lengthy printed outline of a science lesson was prepared which contained numerous suggestions that would lead to various style of teaching. The teacher was provided with the materials needed to teach the lesson. Thus they all had common curricular materials but freedom and incentive to choose the teaching style they wished to use. A group of 28 teachers was randomly choosen from the 150 participating teachers for a pre-test and a different 28 were randomly selected for the post-test. The change was significant at the .01 level (one tailed

test) with the average rating changing from 4.98 to 5.64. (s = .97)

The secondary science study[4] in which the beta form was employed, involved a quasi-experiment to asses effects of three supervisory methods used to facilitate the development of an inductive - indirect teaching strategy, i.e. a guided inquiry. The subjects were secondary science student teachers and the instrument was used to ascertain degree of desired strategy exhibited during a twenty minute video taped post-lab discussion session. Since all participants were striving for maximum performance the "instrument-task" required differentiation at a high level. This, along with a small sample size of six per group, was not conducive to providing the power necessary to detect differences among groups, although a definite trend was differentiated among the group means. Inter-rater reliability (Hoyt) for this use of the instrument was .95 over four raters randomly assigned to tapes so that each tape was rated by two persons.

[1]Winer, B. J., Statistical Principles in Experimental Design, (New York: McGraw Hill Book Co.) 1962 p. 126-28.

[2]Struthers, Joseph A., Boulder Elementary Science Project: Developing Creative and Critical Thinking Through An Elementary Science Program. Final Report of PACE No. 1312. Boulder Valley Schools, Boulder, Colorado. August, 1969 (mimeo).

[3]Anderson, Ronald D. and Horn, Jerry G., "Evaluation of the Colorado Elementary Science Project." A paper presented at the annual convention of the National Association for Research in Science Teaching, Minneapolis, Minnesota, March 7, 1970.

[4]James, Helen H. "Differential Efficacy of Three Supervisory Methods for Development of a Teaching Strategy." A paper presented at the annual Convention of the American Educational Research Association, Minneapolis, Minnesota, March 5, 1970.